Halifax-Dartmouth Metropolitan Sewage Treatment Facility

ENVIRONMENTAL ASSESSMENT REPORT

Executive Summary

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REPORT TO

HALIFAX HARBOUR CLEANUP INC.

ENVIRONMENTAL ASSESSMENT REPORT

FOR THE

HALIFAX-DARTMOUTH METROPOLITAN

SEWAGE TREATMENT FACILITY

EXECUTIVE SUMMARY

Prepared by:

Jacques Whitford Environment Limited
3 Spectacle Lake Drive
Dartmouth, Nova Scotia B3B 1W8
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EXECUTIVE SUMMARY

Introduction

This executive summary provides an overview of the environmental assessment of the proposed Halifax-Dartmouth Metropolitan Sewage Treatment Facility, prepared on behalf of the proponent, Halifax Harbour Cleanup Incorporated (HHCI). HHCI's mandate is to implement the design and construction of a wastewater interception and treatment system as one component of the overall management of wastewater in the Halifax-Dartmouth metropolitan area. HHCI was incorporated in 1989 under the *Companies Act* of Nova Scotia and is funded by the federal and provincial governments, the cities of Halifax and Dartmouth and the Municipality of the County of Halifax.

The proposed facility consists of a collector system of piped sewers, tunnels, pumping stations, and combined sewer overflows (CSOs) to intercept wastewater from 40 existing outfalls around the harbour; a single regional sewage treatment plant providing primary treatment, disinfection, and sludge conversion located at Ives Cove; and a diffuser to discharge treated sewage so that a high dilution with harbour waters is achieved. Due to the commitment of federal funding, as outlined in the Canada-Nova Scotia Subsidiary Agreement on Halifax-Dartmouth Metropolitan Area Development, the project is subject to environmental assessment as per Section 6 of the federal *Environmental Assessment and Review Process (EARP) Guidelines Order*. The Province of Nova Scotia also committed to

conduct a full assessment of the project under its own Environmental Assessment Act with appropriate public review. In light of the benefits and efficiencies of satisfying the concerns of both levels of government, a joint federal-provincial environmental assessment was undertaken.

The purpose of environmental assessment is to identify and evaluate the potential environmental effects of the project early in the planning stages. It provides the proponent, HHCI, with an opportunity to incorporate environmental considerations and mitigation into the project concept and design. The process also provides an opportunity for government agencies and the public to evaluate the project and the acceptability of the predicted adverse impacts and benefits that result from it.

The environmental assessment process for the Halifax-Dartmouth Metropolitan Sewage Treatment Facility began with the registration of the project on 2 January 1991. The project is being reviewed by an independent joint Federal-Provincial Environmental Assessment Review Panel and this Environmental Assessment Report (EAR) has been prepared in response to the Final Terms of Reference dated 25 June 1991.

The EAR will serve as the main reference document for the Panel, the public and government agencies to evaluate the project. Following the review of the EAR, the Panel will hold public hearings and submit a report and recommendations to the federal and provincial Ministers of the Environment and the federal Minister responsible for the Atlantic Canada Opportunities Agency for a final decision. Once the project receives ministerial approval, final design will begin. The sewage treatment facility could be ready for its initial phase of operation by 1999.

Existing Condition of Halifax Harbour

Halifax Harbour is an estuary in the sense that water circulation is typically characterized by a two-layered flow. Incoming waters, which are saltier and heavier, enter along the bottom while the outgoing flow at or near the surface is driven by freshwater river discharge and by runoff from the surrounding land.

The harbour currently receives contaminants from a variety of sources, including domestic sewage, commercial and industrial facilities, institutions, surface runoff, sediments, atmospheric inputs, and ship-related discharges. Contaminants resulting from human activity that are released into the harbour include pathogenic bacteria and viruses; heavy metals such as copper, lead, and mercury; trace organic compounds such as petroleum hydrocarbons, pesticides, polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB); silt; and plastics and other floating debris. In the EAR, the concentrations of these various contaminants in the harbour are compared to environmental quality guidelines. These guidelines are established by government agencies to protect marine life and human health.

In particular, because Canada does not have any available guidelines for contaminants to protect marine life, USEPA 1986 guidelines are used in the EAR. The sediment contaminant levels are compared to the Canadian Environmental Protection Act Interim Screening Levels for Ocean Disposal, the only Canadian guidelines that apply to sediments. These guidelines are more recent than those adopted by the Halifax Harbour Task Force.

Bacterial concentrations in Halifax Harbour waters are highest near sewer outfalls. Faecal coliform concentrations in the harbour do not meet the federal guidelines for shellfish consumption. The shellfish fishery in the harbour has been closed for several decades as a result of high bacterial concentrations in harbour waters. Using present provincial water quality criteria (based on faecal coliform bacteria levels), swimming at Black Rock Beach and the Dingle is occasionally unacceptable.

High concentrations of organic matter and nutrients (e.g., nitrogen and phosphorus) and low oxygen levels in sediments and water occur primarily near existing sewage outfalls. For the harbour in general, the nutrient concentrations are not excessive in either sediments or water and are comparable to those measured in other less developed inlets along the Atlantic coast. Also, the harbour waters generally have a higher concentration of oxygen, which is beneficial to marine life. Organic matter accumulation, however, is higher in Halifax Harbour sediments than in other estuaries in Atlantic Canada.

Concentrations of heavy metals (i.e., mercury, copper, iron, manganese, nickel, lead, and zinc) in Halifax Harbour water and sediments have been increasing since European settlement of the area and have increased dramatically since the late 1800s. Broad areas of sediment in the inner harbour (between the Narrows and McNabs Island), Northwest Arm, and Bedford Basin (Figure ES.1) can be classified as contaminated as they exceed the sediment quality guidelines for copper, lead, zinc, and mercury contained in the Canadian Environmental Protection Act Interim Screening Levels for Ocean Disposal. Current heavy metal concentrations in Halifax Harbour waters are similar to those in other inshore Canadian waters and are within USEPA 1986 guidelines. Elevated concentrations of most metals are presumed to originate from human sources.

Trace organic contaminants, including polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB), are present at elevated levels in the harbour sediments. PAH and PCB concentrations in harbour sediments exceed the Canadian Environmental Protection Act Interim Screening Levels for Ocean Disposal.

Up to one-third of shoreline litter counted at locations around Halifax Harbour is attributable to sewage discharges, the remainder attributed to littering from shore and from vessels. Litter presents both an aesthetic problem and a potential hazard to marine organisms. An additional aesthetic problem is the "boil" from existing nearshore outfalls that is easily visible from shore during and shortly after rainfalls.

Future Condition of Halifax Harbour—No Project Scenario

Given future population growth and forecast increases in wastewater flows, it is reasonable to conclude that the wastewater discharges into the harbour will increase substantially in volume, particularly in the absence of any sewage management strategy and source control (i.e., techniques to reduce the volume and types of discharges into municipal sewers) and treatment initiatives. Consequently, the harbour will continue to receive contaminants, resulting in a further degradation in the environmental quality of the harbour.

In the sediments, existing conditions of high bacterial concentrations, organic matter accumulation, depressed oxygen levels, and nutrient enrichment (particularly near sewage outfalls) may be expected to increase and affected areas expand. Elevated concentrations of metals and organic compounds will persist and likely increase further, particularly as sediments act as a receiving environment for these contaminants. Problems with the aesthetic appearance of the harbour water and shoreline resulting from litter and floatables originating from sewage discharges will likely increase.

As contaminant loads in the harbour water and sediments increase, it is reasonable to expect the current trends of uptake and bioaccumulation (the increasing concentration in successive levels of the food chain of a contaminant or substance) of contaminants by marine organisms will continue. Assuming continued population growth in the region, the concentration of human pathogens will increase and any benefit currently derived from dilution with harbour water will continue to decrease. Bacterial concentrations can be expected to continue to exceed federal guidelines for shellfish consumption and may worsen sufficiently to exceed provincial guidelines for primary contact recreation (i.e., swimming) more frequently than is now recorded. Given this potential for continued input of contaminants to the harbour, consequent impairment of some traditional uses such as fishing, contact recreational activities (e.g., swimming and boating), and aesthetic enjoyment may be expected.

Rationale for the Undertaking

The purpose of the proposed Halifax-Dartmouth Metropolitan Sewage Treatment Facility is to provide the metropolitan area with a sewage collection and treatment system that will prevent the continued lowering of harbour environmental quality due to uncontrolled discharges of untreated sewage. The major benefit of the project will be an improvement in the environmental quality and ability of the harbour to sustain marine organisms and promote harbour-related uses. This improvement in harbour environmental quality is seen as a potential impetus for enhanced economic development in the Halifax-Dartmouth metropolitan area, particularly in those industries that rely on a high standard of environmental quality (e.g., fisheries, tourism and recreation, research). In addition, the project presents the opportunity to promote the application of new environmental technology in Nova Scotia: converting domestic sludge produced at the STP to a marketable oil product.

The consolidation of existing sewage outfalls and management of CSOs, coupled with the provision of primary level treatment and disinfection of wastewater, will contribute to

reduced harbour pollution. However, the collection and treatment of wastewater effluent is only one component of wastewater management and in no way diminishes the importance of source control initiatives and other components of the overall management of wastewater in the region (e.g., diversion of runoff, household hazardous waste collection, public education to promote reduction of water use, and proper management of domestic and other hazardous wastes). Coupled with source control initiatives, the proposed facility is an integral part of a regional water and wastewater management strategy, and is consistent with the policy statements relating to the provision of municipal water and sewer infrastructure outlined in the Federal Water Policy.

Alternatives Considered

Over the last 25 years, numerous studies have been carried out to examine the management of sewage from the Halifax–Dartmouth metropolitan area. The concept of a single regional sewage treatment plant (STP) with primary treatment was formulated in 1977 during a study conducted by the Metropolitan Area Planning Commission (MAPC). That study recommended that an STP be located at Sandwich Point near Herring Cove. A second MAPC Study in 1987 conducted by CBCL Limited substantiated the findings of the 1977 report.

In 1989, the Halifax Harbour Cleanup Review Committee was established by the Nova Scotia Environmental Control Council to review the wastewater management issue. The committee concluded that the location of the outfall diffuser should take precedence over containment strategies of effluent discharge. The siting of the outfall in deep water in the outer harbour (i.e., south of the south end of McNabs Island), as recommended in earlier studies, is consistent with the dispersal strategy for minimizing adverse effects on water quality by ensuring maximum dilution of the treated effluent. Siting of the outfall in the inner harbour (i.e., north of the south end of McNabs Island) may result in more apparent localized adverse environmental effects, but is consistent with modern concepts of environmental responsibility relating to containing waste within the area of its generation. The Halifax Harbour Cleanup Review Committee adopted the dispersal strategy, recommending a diffuser outfall extending beyond the mouth of the harbour, away from areas that support resource use and recreational activities. However, the committee decided that it could not properly evaluate the proposed STP site at Sandwich Point because of the absence of water quality objectives, the lack of an understanding of the marine environment, and the need for a more effective public participation in the decision making process.

In order to address the lack of data, the province commissioned a new water quality study of Halifax Harbour. That study, completed in 1990, showed that Halifax Harbour is characterized by relatively high flushing rates, and that effluent from a primary STP discharged into the inner or outer harbour would satisfy most water quality concerns. It was, however, noted that no diffuser location north of the south end of McNabs Island could ensure faecal coliform levels below the recommended maximum concentration for shellfish harvesting in nearshore areas of the harbour. Further review of the MAPC (1977, 1987)

recommendation for a diffuser outfall near Herring Cove showed that low currents in that area made it a poor choice for an outfall location.

In 1989, the Halifax Harbour Task Force, chaired by Dr. Robert Fournier, was formed to review the proposed regional sewage treatment strategy. The task force, which issued its final report in August 1990, supported the concept of a single regional STP with primary treatment, allowing for upgrading in the future. In selecting the level of sewage treatment, the task force considered a number of factors, including the efficiency of removal of potential contaminants; the potential fate and effects of those contaminants on the receiving environment in the context of the existing environmental quality; land requirements; and capital and operating costs. Primary treatment, coupled with strong source control initiatives in an integrated waste management program, was determined to offer the optimal balance of removal efficiency, land requirements, and costs. The task force also evaluated 16 possible sites, ultimately recommending a short list of five, including McNabs Island, Oil Refinery Lands (two locations), Woodside Industrial Park, Halifax Rail Yards, and Purcells Cove Backlands.

For ease of reference, the task force divided Halifax Harbour into six areas: Bedford Basin, the Narrows, inner harbour, middle harbour, outer harbour, and the harbour approaches (Figure ES.1). Unless otherwise indicated, future reference to "the harbour" encompasses the whole harbour.

While agreeing with previous studies that the outfall diffuser location takes precedence over the STP site, the task force favoured the principle of containment over dispersal of treated effluent, an approach consistent with the 1985 Guidelines for the Protection of the Marine Environment Against Pollution from Land-Based Sources, often referred to as the Montreal Guidelines, developed under the auspices of the United Nations Environment Programme (UNEP). An inner harbour outfall was therefore recommended.

Other results of the task force study included the development of a set of environmental quality objectives, taking into consideration the variable water and sediment quality requirements for different harbour uses. The task force concluded that an inner harbour diffuser discharging effluent from a primary treatment plant would meet the required guidelines for water quality.

Based on the terms of the Memorandum of Agreement dated 31 March 1989 between the Province of Nova Scotia, the cities of Halifax and Dartmouth, and the Municipality of the County of Halifax, HHCI was incorporated to implement the design and construction of the regional sewage interception and treatment system. HHCI has adopted and intends to implement, within its mandate (as outlined in the Memorandum of Agreement dated 28 July 1989 between the Province of Nova Scotia and HHCI), all of the recommendations of the task force.

Once HHCI was incorporated, it commissioned three studies to assess the suitability of the five sites recommended by the task force. These studies addressed the technical, financial, public perception, and environmental aspects of site selection.

The technical and financial aspects of each of the five sites were addressed in a report issued in February 1991. The study assumed that the McNabs Island STP site would be confined to an area in Ives Cove off the north end of the island. Although relatively more expensive to construct, the long-term operating and maintenance costs for the Ives Cove option would be considerably less than for those sites that were located higher above sea level and would require increased pumping to lift the raw sewage from the interceptor to the STP.

The results of a public opinion survey of Halifax and Dartmouth residents concerning a number of harbour issues, including the harbour cleanup and specific siting issues related to the STP, were released in May 1991. The survey results revealed a broad consensus among area residents that Halifax Harbour is heavily polluted and that the primary source of contamination is untreated domestic sewage. The survey results showed that most residents feel that pollution of the harbour has a discernible impact on the quality of life in the area, particularly in terms of recreational opportunities. They also consider sewage in the harbour to be a hazard to both fish and wildlife, as well as to public health.

In a third report, released about the same time as the public opinion survey results, each of the five sites was evaluated using a number of criteria including cost, aspects of the biophysical and socioeconomic environment, and public perception. Based on this analysis, the report recommended that the regional STP be located on an artificial island in Ives Cove off the north end of McNabs Island.

The task force had also proposed that an outfall diffuser location northeast of Georges Island be investigated. However, the Halifax Port Corporation (HPC), in its capacity as Port Authority, rejected the proposed location on the basis of concerns relating to marine navigation. HPC proposed a preferred site immediately west of Ives Point, approximately 700 m from the shore of McNabs Island. The Canadian Coast Guard concurred with the HPC's recommendations. The new outfall diffuser location was adopted by HHCI.

Oil from Sludge (OFS) technology was selected for sludge management, as it offers an environmentally superior process relating to odour control, stabilization of metals (by fixation in ash), reduction of exhaust gases, and destruction of viruses and bacteria that are retained in the sewage sludge. The OFS process produces a marketable liquid hydrocarbon which has potential for use as an asphalt additive. Furthermore, federal funding is contingent on the incorporation of OFS technology in the regional STP.

Alternative interceptor configurations were considered, including two separate tunnels extending southward along the Halifax and Dartmouth waterfronts with separate harbour crossings to Ives Cove, a tunnel interceptor flowing clockwise from Halifax to Dartmouth

and from Dartmouth to the artificial island, and a tunnel interceptor flowing counterclockwise from Dartmouth to Halifax and from Halifax to the STP. The latter configuration was selected as it offered the most design advantages and lower costs. The level of treatment at CSOs was designed in consideration of the water quality objectives set by the task force, and endorsed by HHCI, for the receiving waters.

Project Overview

The development of the project components, including facility siting and design, has been and continues to be an iterative process; environmental considerations are incorporated into the project design as they are identified during the environmental assessment and pre-design processes.

The project involves the construction and operation of a sewage collection and treatment system. The STP will be located on an artificial island constructed in Ives Cove off the north end of McNabs Island and the outfall diffuser will be located in the inner harbour, west of McNabs Island (Figure ES.2).

The sewage collector system requires construction of an interceptor tunnel and the necessary pumping stations and CSOs to receive, convey, and treat raw sewage from about 40 existing outfalls around the harbour. The interceptor system will be approximately 25 km long, of which about 75% will be tunnelled. The interceptor system will be constructed using a combination of techniques such as excavation trenching, drilling and blasting, and tunnel boring machines.

The interceptor tunnel will be designed to carry large quantities of stormwater. However, it is not economically feasible to collect and treat the peak total flow during wet weather. During storm events, therefore, there will be an overflow of wastewater into the harbour, contributing about 3.4% of the total annual freshwater flow into the harbour, in contrast to the current 20%. Separation of solids and liquids, referred to as preliminary treatment, will reduce solids and remove floatables from this overflow. On a yearly average, 88% of the 270 million litres per day of raw sewage and stormwater currently discharged into the harbour from existing outfalls will be intercepted.

A 10 ha artificial island will be constructed off Ives Cove to accommodate a the STP and OFS facility. The artificial island will be large enough to accommodate future expansion of the primary treatment facility or upgrading of the level of treatment if required. Sewage sludge processed through the OFS facility will yield marketable oil and produce an inert residue that will be transported in a covered vehicle to an approved landfill site, or otherwise disposed of as useful fill material.

The design of the artificial island and STP facilities incorporates a number of environmental considerations, including backup systems to protect against interruptions in service, enclosure

of facilities to minimize noise and odour, and landscaping, design, and placement of plant facilities to enhance visual appearance of the site.

Treated sewage will be discharged through a marine outfall diffuser via a subsea tunnel. The outfall diffuser will be located west of McNabs Island on the seabed of the inner harbour and will provide a minimum 66:1 initial dilution of the treated effluent. This dilution ratio will ensure that the water quality guidelines suggested by Fournier (1990) for suspended particulate matter, metals, and organics will be met in the inner harbour. During dry weather, the sewage treatment facilities will remove from intercepted wastewater all floatables, 60% of suspended solids, 30% of biological oxygen demand, 5–10% of nutrients, and 5–50% of organics and trace metals. The dispersion of contaminants remaining in the discharged effluent will be variable, depending on the dominant currents and the vertical location of the effluent plume in the water column. An estimated 10-15% of the suspended particulate fraction will settle out within 200 m of the diffuser. The remainder, along with the dissolved fraction, will be dispersed either out of or into the harbour.

The construction of these facilities is expected to take four years to complete. For the purpose of budgeting, costing, and scheduling, the life span of the project has been taken as 60 years, but with standard maintenance, replacement, and upgrading, the facility should be operational for a much longer period.

Project Boundaries

Project boundaries are established to help focus the assessment of potential environmental effects on those times are areas during and within which some aspects of the project may affect some components of the environment. The boundaries of the project are defined by the temporal (time-related) and spatial (areal or space-related), characteristics of the construction and operation of each component of the project: the STP and OFS facilities, collector system, and the outfall diffuser. Temporal project boundaries encompass those periods during which project activities will be undertaken, that may overlap with biophysical and socioeconomic environment may be expected. The temporal boundaries of the construction phase of the project range from approximately six months at individual construction sites along the collector system to the four years required to construct the artificial island and the STP. The temporal boundaries of the operation phase of the project encompass its projected life span.

Similarly, spatial project boundaries encompass those areas within which project activities will be undertaken and may interact with the environment. For example, during construction, the surface area estimated to be disturbed ranges from 350 m^2 to 2,000 m^2 at the 31 construction sites along the collection system to 11.2 ha at the infilled area of Ives Cove. The construction of the diffuser may disturb up to 0.2 ha of the seafloor. During operation, the spatial boundaries encompass the facilities themselves, ranging in size from individual manholes to the STP facility. Areas affected by routine maintenance activities, by traffic

associated with the transportation of personnel and materials, and by emissions and effluents from the system are also included within the spatial project boundaries.

Biophysical Environmental Setting

The principal feature of the natural environment of the proposed sewage collection and treatment project is the harbour and nearshore environment. Although the harbour has received human and industrial wastes since the 1700s, it remains a diverse marine ecosystem comprising microorganisms, plant life ranging from phytoplankton to large seaweeds, a variety of bottom-dwelling or benthic organisms ranging from worms to crab and lobster, fish stocks including cod, herring and mackerel, marine mammals such as whales, dolphins, and seals, and a variety of residential and migratory bird life such as seabirds, waterfowl, wading birds, shorebirds, and raptors.

The terrestrial component of the study area encompasses those features in the vicinity of Halifax Harbour that may be directly or indirectly affected by the project. Most of the construction anticipated for the interceptor system will occur in already disturbed urban areas such as vacant lots or parking areas in Halifax, Dartmouth, and Herring Cove. In contrast, McNabs Island and the backlands of Halifax Mainland South, although not directly affected by the project, are characterized by relatively undisturbed natural habitat.

Socioeconomic Environmental Setting

Project construction and operation will affect people in the Halifax–Dartmouth metropolitan area in various ways. The metro area includes the entire western half of the Municipality of the County of Halifax from Hubbards to Musquodoboit Harbour, comprising a total land area of approximately 2,500 km^2. The study area encompasses lands and waters in three municipalities: the Municipality of the County of Halifax (including Herring Cove), the City of Halifax, and the City of Dartmouth.

Metro's population in 1991 is estimated at 310,273, representing more than one-third of the total population of Nova Scotia (893,510). The most densely populated areas within metro are for the most part within the Halifax Peninsula and adjacent to Halifax Harbour and Northwest Arm.

The metro area is a regional centre for both private and government sectors. It is the regional headquarters for many banks, trusts, and insurance companies and serves as the regional hub of many federal and military departmental offices. Because Halifax is the capital of Nova Scotia, many provincial government offices are located within the area.

Halifax Harbour and its port operations have been the historic focus for human activities in the region. The harbour continues to play a vital sustaining role in the livelihood and well-being of metro's population. Harbour uses include commercial shipping, ferry service, recreation and tourism, fisheries, fish holding facilities, cooling water, scientific research, and military activities. Lands around the shore of the harbour are used for purposes ranging

from residential and park to industrial. The most prevalent land uses around the inner harbour are commercial (business district) and industrial, with a measure devoted to the military. Point Pleasant Park and McNabs, Lawlor, and Devils islands remain as undeveloped reserves within the harbour setting.

Municipal and regional land use plans have designated McNabs Island as a park or the equivalent to a park. Ownership of the land on the island is split among the federal government (50%), the Province of Nova Scotia (40%), and private owners (10%).

Assessment Methodology

The methodology used in this EAR is based on that used in other recent federal and provincial environmental assessments. This EAR focuses on the assessment of environmental effects on Valued Environmental Components; that is, components of the biophysical and socioeconomic environment that are valued by society and upon which concern is primarily focused. The Valued Environmental Components for this EAR are identified based on public, professional and economic concerns, as reflected in the results of public consultations, previous studies, professional judgement, and the Final Terms of Reference.

Temporal and spatial boundaries are identified for each Valued Environmental Component with respect to those periods and areas during and within which they would likely interact with project activities. A set of rating criteria is developed for each component to evaluate whether impacts are expected to be negative (with a ranking of significant or insignificant) or whether the interaction might result in a benefit. Generally, the significance of a potential impact is assessed based on the extent and duration of the interaction, the sensitivity of any given environmental component, and the ability of the environmental component to recover from adverse impacts.

Valued Environmental Components in the biophysical environment are referred to as Valued Ecosystem Components and include terrestrial habitat, Osprey, Great Blue Heron, groundwater, and air quality, as elements of the terrestrial environment. The marine benthic community, marine water quality, marine sediment quality, and coastal physiography are recognized as important elements of the marine biophysical environment.

Valued Environmental Components in the socioeconomic environment are referred to as Valued Socioeconomic Components and consist of economic opportunities, community life, land use and value, visual resources, tourism and recreation, commercial fisheries, transportation infrastructure, archaeological and heritage resources, and public health. Each of these components is evaluated for potential interactions with project construction and operation.

The EAR contains an evaluation of possible interactions between Valued Environmental Components and potential accidental events. By definition, accidental events are unpredictable. The EAR outlines preventive measures and response techniques which will

contribute to a reduction not only in the probability of an accidental event, but also in its potential severity.

To facilitate the analysis of the potential interactions between the project and the environment, a matrix approach is used wherein project activities were listed on one axis on the matrix and environmental component on the other. The nature and magnitude of the predicted environmental effect is evaluated based on what may occur after the implementation of standard design and engineering practices, but in the absence of any specific mitigative measures (i.e., measures that avoid or otherwise reduce the level of predicted impacts).

An environmental protection or mitigation strategy is presented in the EAR to minimize or eliminate the potential impacts. HHCI's mitigation strategy includes the following items:

- The incorporation of environmental planning and mitigation throughout the project design
- The avoidance of potential interactions with the Valued Environmental Components through scheduling, routing, site selection, and the assessment of alternatives
- An approach to compensation
- The commitment to Environmental Protection Planning, including contingency plans for accidental or unplanned events, environmental orientation for employees, and site-specific mitigation measures

Mitigative measures that should be incorporated into the operational aspects of the project by the future operator are also identified.

Residual Impacts

Residual impacts are impacts that persist after all proposed mitigation measures have been implemented.

The construction of the artificial island will result in a significant residual impact on the marine benthic community due to the net loss of approximately 9.2 ha of marine benthic habitat. The current benthic community in the area of the artificial island has a higher diversity than other areas of the harbour, being dominated by leafy marine algae, molluscs, small crustacea, and numerous polychaete (marine worms). Suggested mitigation to reduce impacts associated with island construction include the use of silt curtains to reduce suspended particulate matter deposition and the use of armour stone (coarse gravel to protect against erosion) to create new uncontaminated habitat for recolonization by bottom dwelling marine organisms. The loss of marine benthic habitat will be partially compensated by the creation of new habitat that can be colonized by benthic invertebrates such as molluscs, starfish, crabs, and possibly lobsters.

Water table decline and water quality degradation may occur in wells close to (i.e., within 300 m) excavation and blasting activities; however, these impacts will largely be restricted in duration to the period of construction. The residual impacts on groundwater resources, because they are either temporary and/or compensable, are anticipated to be insignificant.

Most of the significant residual impacts on the socioeconomic environment are associated with the construction of the project. Construction activities will be temporary, lasting for one month at small interceptor point shafts, six months at most CSO locations, one year at the larger CSOs, two years at the minehead shafts, and three to four years at the STP/OFS. Though reduced by mitigation, significant residual impacts are anticipated during the construction period for community life (in the Halifax North End, Downtown Halifax, and Halifax South End communities), land use and value (Duke/Lower Water Street intersection, Balmoral Road and in Herring Cove), and a number of sites with regard to visual resources. These construction impacts can be reduced, though not eliminated, by minimization of site area and disturbance, reduced construction periods, and effective public information and community liaison.

During project operation, it is anticipated that significant residual impacts will remain with regard to land use and value (Balmoral Road) and visual resources (STP/OFS facility, Balmoral Road). Residual impacts may be reduced by appropriate landscaping and plantings and innovative site and facility design. It is anticipated that the significant residual visual impacts will be reduced to insignificant as screening vegetation matures (five to ten years for the STP/OFS facility, or sooner if mature vegetation is used).

Monitoring During Construction

The EAR describes and makes recommendations for two types of monitoring regarding this project: environmental compliance and environmental effects monitoring. Environmental compliance monitoring (ECM) includes monitoring of activities by both government agencies and the proponent to ensure compliance with regulatory and self-imposed environmental requirements. Environmental effects monitoring (EEM) is performed to validate impact predictions and the effectiveness of mitigation and compensatory measures. In some instances, monitoring may lead to improving or otherwise altering these measures.

HHCI intends to comply fully with the requirements of all permits, authorizations, and approvals under the applicable regulations. The self-regulatory ECM will include applying the Environmental Protection Plan, which is the key tool for implementing mitigation.

To address its own responsibilities during construction, HHCI proposes the establishment of a multidisciplinary EEM Advisory Committee which will include impartial experts to guide the technical aspects of the studies. HHCI will work with municipal, provincial, and federal regulatory agencies and other groups who will also benefit from the EEM program. Based on the results of the impact assessment, a number of monitoring studies are proposed to be included in the EEM program. During the construction period, proposed EEM includes

studies related to groundwater, air quality, the marine benthic community, marine water quality, sediment quality, sediment dynamics, the economy, visual resources, tourism and recreation, archaeological and heritage resources, and public health.

Monitoring During Operation

The EAR also describes and makes recommendations for monitoring during the operation of the proposed facility. The responsibility for monitoring during the operation of the proposed sewage collection and treatment facility will ultimately rest with the future operator. Federal and provincial regulatory and scientific authorities will also share responsibility with the future operator for carrying out the monitoring programs developed in cooperation with HHCI during the design and construction phases of the project.

Public Information and Involvement Program

Public information and involvement have been a formal part of this project since 1988. The practice has been to include the public in project activities by providing information and allowing a meaningful review and comment process. Public involvement has also been part of the consideration of both an appropriate STP site and of project alternatives.

HHCI's proposed public information and involvement program reflects the four phases of the project: pre-design, design, construction, and commissioning. After commissioning, the ongoing public information and involvement program will be the responsibility of the future operator. During predesign, HHCI's progress reporting is expected to include a quarterly newspaper, radio announcements, newspaper inserts, an information kiosk, messages accompanying water bills, a school program, targeted briefings, and public speaking engagements. Special public education materials will be developed to address and promote such topics as water conservation and source control of toxic materials. The pre-design phase will end with a report that will become a detailed guide for the designer. The report will be distributed to information centres, and individuals and organizations on HHCI's mailing list will be informed of its availability.

Following a decision by the responsible ministers to proceed with the project, it is proposed that a Citizens' Advisory Committee (CAC) be established, through the cooperation of HHCI and other interested parties, consisting of individuals representing harbour-related interests, the local scientific community, and citizens. The objectives proposed for the CAC are to act as liaison between the public and HHCI, bringing forward current issues or concerns; to facilitate public participation programs; to help educate the public about the proposed action and the decision making process; to review and comment on documentation as requested by HHCI; and to assist in developing and evaluating choices about the proposed sewage treatment system and helping to resolve conflicts among different interest groups.

A condensed master project schedule and the list of proposed contracts and tenders will be made available to the general public. In addition, as designs of project components are completed, selected drawings will be published for public information. Detailed designs and

specifications will be made available for public review at the information centres as well as at other centres such as the Construction Association and facilities of the participating municipalities. The public will be able to comment on design through various mechanisms, including a public comment telephone line. HHCI is exploring other means of obtaining public comments such as open houses and community meetings. HHCI is committed to responding to individual questions and concerns; a record of all complaints and responses will be available to the public.

Neighbourhoods and community members likely to be affected by construction will receive copies of the master schedule. Pre-construction information packages will subsequently be distributed and will describe how different areas may be affected by construction. The public will provide feedback through the CAC and targeted briefings will be scheduled for special interest, community, and governmental groups. An emergency response plan will be in place before operations begin; this plan would address possible crises and communications procedures that would be used in each case.

Conclusion of Environmental Assessment Report

While the construction and operation of the proposed sewage collection and treatment facility are anticipated to have some residual adverse impacts on various components of the biophysical and socioeconomic environment, a number of important positive effects are expected to accrue.

It is important to evaluate the costs and benefits of the project in the context of existing harbour conditions. Once the facility is commissioned, raw sewage will no longer be continuously discharged at numerous points throughout the inner harbour. Marine water and sediment quality in the inner harbour are expected to improve as a direct result of the interception and treatment of sewage; other components of the biophysical and socioeconomic environment are expected to benefit indirectly from these improvements in environmental quality. The marine benthic community, the local and provincial economy, tourism and recreation, community life, commercial fisheries, public health, heritage resources, and scientific research will also likely benefit from various aspects of the construction and operation of the project.

During the construction period, positive economic effects will be realized locally and provincially. About 1,700 person-years of employment will result, with over $63 million in wages for Nova Scotia workers. Many local business opportunities will be created to provide necessary materials, equipment, and manufacturing expertise. It is estimated that a total of $91 million in goods and services can originate from within the region. Methods have been recommended to enhance local economic benefits such as dividing large tenders and creating a database of local suppliers. Economic benefits will continue during project operation, though on a smaller scale, to meet demands for staff and supplies.

Reducing the volume of wastewater discharged to the harbour and reducing the number of discharge points is expected to have a positive effect harbour marine life. The treatment afforded by the STP will reduce suspended particulate matter (SPM) loading into the harbour, an additional benefit to harbour marine life. Many of the localized water quality problems encountered at existing outfalls, including accumulation of floatables, oxygen depression, and algae growth, will be reduced. Despite the localized reduction of water quality within the mixing zone of the diffuser, the interception and treatment of wastewater is expected to have an overall positive effect on marine water quality in the inner harbour, although it is not known whether this improvement will be sufficient to meet the new federal guidelines for recreational water quality. The reduction in SPM and contaminant loading will also result in a beneficial effect on marine sediment quality.

Project operation will result in several long-term positive effects on the Valued Socioeconomic Components. Tourism, recreation, and community life in the study area are inextricably joined to Halifax Harbour and will benefit from cleaner harbour waters and shoreline. Commercial fisheries in the harbour will experience a reduction in gear fouling and an enhancement of seafood quality and marketability. Any increase in knowledge about the archaeology and history of the metro area that results from mitigative activities is considered a positive effect.

A great deal of effort has gone into the review of existing literature and new research into the various aspects of the physical, biological, social, and economic aspects of Halifax Harbour and its surrounding communities. The result of this effort has been an expanded database on the existing conditions, a synopsis of the existing knowledge, and a renewed appreciation of the complexity of the environment in the region.

It is now widely recognized that responsible environmental stewardship involves the management of our own wastes within our own region. The proposed sewage interception and treatment facility is an important component of a regional wastewater management strategy. The facility is consistent with the principle of sustainable development in the sense that the project is the first step in ensuring the enjoyment of the harbour by future generations. These principles are in keeping with those outlined by the World Commission on Environment and Development (1987), the 1985 Guidelines for the Protection of the Marine Environment Against Pollution from Land-Based Sources, and recently emphasized in Canada's Green Plan.

In addition to the obvious benefits resulting from the proposed facility, the project has the potential to promote an integrated approach to harbour management by fostering an environment of cooperation among those interested in the harbour and by contributing to the expansion of knowledge and heightening of awareness regarding environmental issues in this region.

GLOSSARY

Benthos, Benthic: This refers to plant and animal communities whose habitat is the sea floor.

Bioaccumulation: The increasing concentration in successive levels of the food chain of a contaminant or substance.

Combined Sewer Overflow: A point in a sewerage system where combined sewage and surface water flows that exceed the capacity of the interceptor sewer are allowed to overflow into adjacent receiving waters.

Containment: The strategy for wastewater management that advocates confinement of potentially hazardous or toxic waste to minimize the area of interaction between the contaminant and the environment.

Contingency Plan: A document outlining procedures to be followed in response to an accidental event.

Diffuser: This is a structure located at the end of a sewage outfall. The diffuser is designed to maximize the dilution of sewage effluent with surrounding water by forcing the effluent to be discharged through a series of ports. The diffuser is placed on the seabed so that the resulting plume, as it rises to the surface, will be further diluted.

Disinfection: The application of chlorine, sodium hypochlorite or a similar compound to wastewater in order to kill pathogenic bacteria before the wastewater is discharged into the ocean.

Dispersal: The strategy for wastewater management that advocates maximizing the rate of dilution of the effluent plume with uncontaminated (sea)water in order to minimize the adverse effects on receiving water quality.

Effluent: Treated wastewater that flows out of a treatment plant, sewer, or industrial outfall.

Environmental Assessment Act: The guiding provincial law for the preparation of environmental impact reviews.

Environmental Assessment and Review Process: The procedure used by federal departments to consider the full environmental implications of all proposals for which they have a decision-making authority or for which they have committed funding.

Environmental Assessment Report: The report prepared by the proponent, HHCI in this case, in accordance with the Terms of Reference to evaluate the environmental implications of the proposal and to present mitigation and monitoring strategies.

Environmental Compliance Monitoring: A program of monitoring the proponent's activities, conducted by both the regulatory authorities and the proponent to ensure compliance with regulatory and self-imposed environmental requirements.

Environmental Effects Monitoring: A program of monitoring undertaken to validate impact predictions, evaluate the effectiveness of mitigation, identify the need to alter or improve mitigative or compensatory measures, and gather additional information regarding poorly understood environmental effects.

Environmental Protection Plan: A document used to facilitate the implementation of all mitigative measures designed to minimize the environmental impact of a proposal.

Faecal Coliform: Intestinal bacteria in humans and other animals that are used as indicators of sewage-contaminated water.

Federal-Provincial Environmental Assessment Review Panel: A group appointed by the federal and provincial Ministers of the Environment to review a proposal that was referred by a federal initiating department for public review.

Final Terms of Reference: The document prepared by a proponent which details how the information requirements and issues contained in the Final Guidelines prepared by the Federal-Provincial Environmental Assessment Review Panel are to be addressed.

Halifax Harbour Cleanup Incorporated: The public agency responsible for the Halifax Harbour Cleanup Project.

Initiating Department: a federal government that, due to its involvement in a proposal either by a funding commitment or other decision—making the authority is required to make a decision regarding the environmental assessment of the proposal.

Interceptor: A sewer that interrupts flows from a number of sewers discharging into adjacent receiving waters and conveys some or all of the flow to a point for treatment or disposal.

Microorganisms: Microscopic organisms, either plant or animal, invisible or barely visible to the naked eye. Examples are algae, bacteria, fungi, protozoa and viruses.

Mitigation: includes (a) avoiding the impact altogether by not taking a certain action, (b) minimizing impacts by limiting the magnitude of the action, (c) rectifying the impact by repairing, rehabilitating or restoring the impacted area, (d) preventing an impact by preservation and maintenance operations and (e) compensating for an impact by replacing or providing substitute resources or environments.

Outfall: The place where effluent is discharged into receiving waters. (May also be used to describe the conduit which carries effluent to receiving waters.)

Pathogens: Disease-causing bacteria.

Plume: The rising discharge of treated effluent from a treatment plant outfall pipe.

Primary Treatment: An initial stage in wastewater treatment. Screens and sedimentation tanks are used to remove most material that floats or will settle. Primary treatment results in the removal of a substantial amount of suspended matter but little or no dissolved matter.

Receiving Waters: A river, lake, ocean or other waterway into which wastewater or treated effluent is discharged.

Residual Impact: The impact remaining after all practicable mitigative measures have been implemented.

Sewage: The organic waterborne waste produced by residential, commercial, and industrial establishments. The term is becoming increasingly synonymous with wastewater.

Sewer: A channel or pipe that carries wastewater and/or storm water runoff from the source to a treatment plant or receiving waterway. Sanitary sewers carry household and commercial waste. Storm sewers carry runoff from rain or snow. Combined sewers are used for both purposes.

Sludge: The accumulated solids separated that either float on the surface of, or are suspended in, wastewater.

Source Control: Techniques to reduce the volume and types of discharges to municipal sewers. Includes redirection of surface runoff, reduced water use, and proper waste disposal practices.

Suspended Particulate Matter: The contribution to suspended solids in water from all sources, including sewage, surface runoff, organic, and inorganic processes.

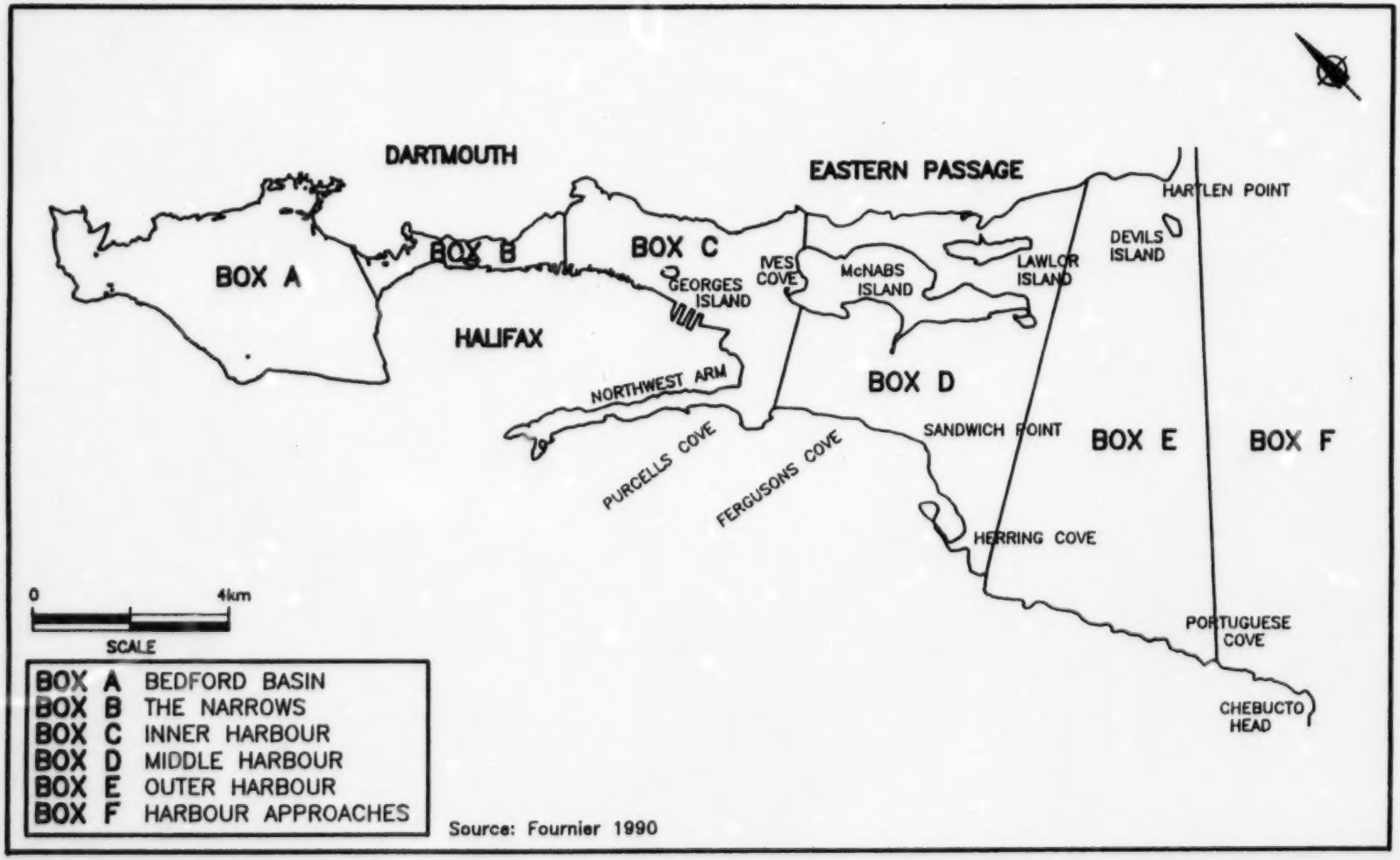
Valued Ecosystem Component: This is an identified biophysical or chemical aspect of the environment that is valued by society.

Valued Socioeconomic Component: This is an identified social, economic, or political aspect of the environment that is valued by society.

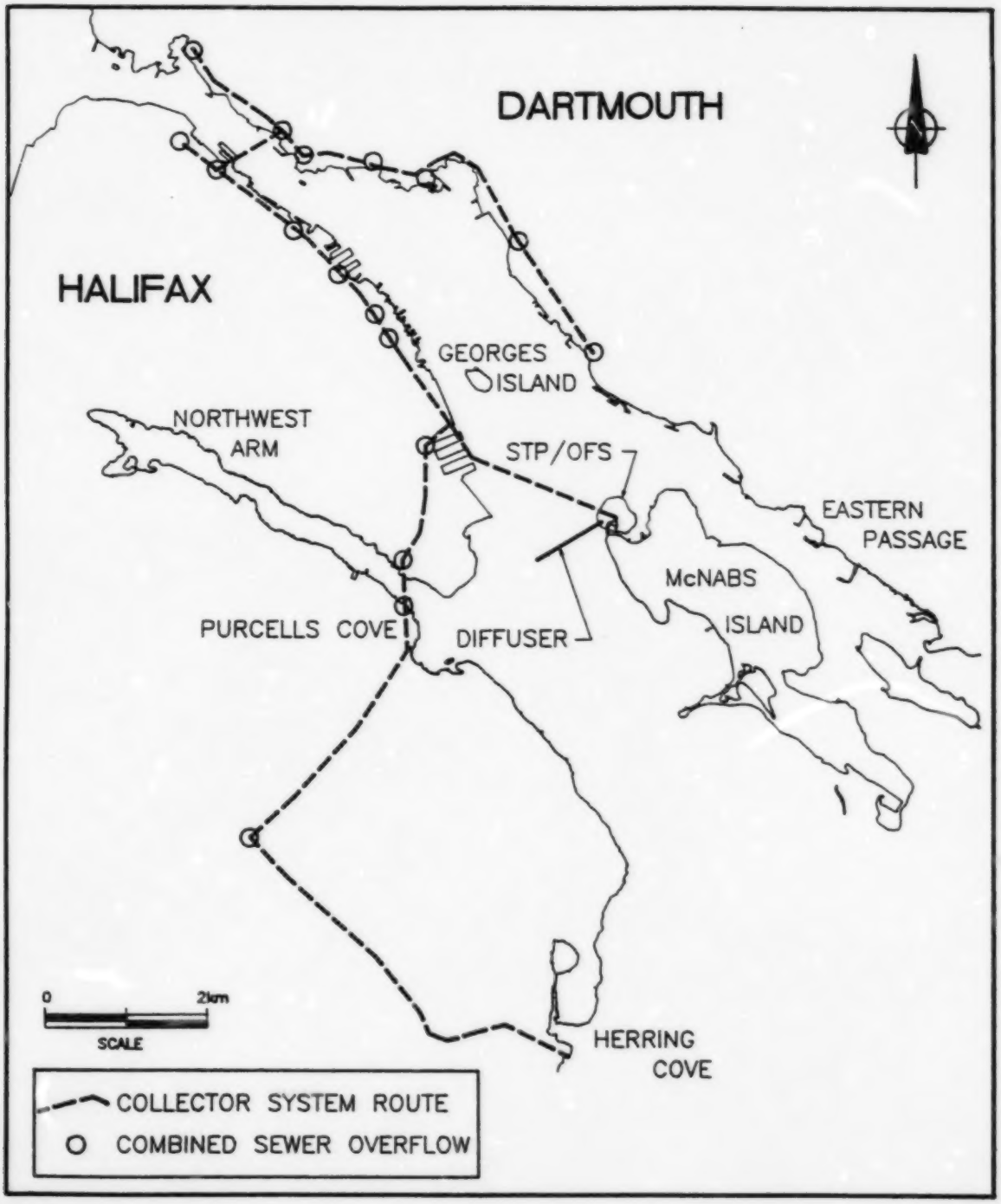
Wastewater: The spent or used water from a community or industry that contains dissolved or suspended matter as pollutants.

ACRONYMS

CSO	Combined Sewer Overflow
EAR	Environmental Assessment Report
EARP	Environmental Assessment Review Panel
EEM	Environmental Effects Monitoring
EPP	Environmental Protection Plan
HHCI	Halifax Harbour Cleanup Inc.
MAPC	Metropolitan Area Planning Commission
OFS	Oil From Sludge
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
STP	Sewage Treatment Plant



	HALIFAX HARBOUR CLEANUP PROJECT	
AUGUST 1992	HALIFAX HARBOUR SUBDIVISIONS	FIGURE ES.1



	HALIFAX HARBOUR CLEANUP PROJECT		
	AUGUST 1992	PROPOSED PROJECT CONFIGURATION	FIGURE ES.2

CONTRIBUTORS

Jacques Whitford Environment Limited was responsible for the preparation of this document in association with **Porter Dillon Limited** and **MacLaren Plansearch (1991) Limited. METRO Engineering Inc.** was primarily responsible for the preparation of the Project Description. Other subconsultants contributing to the document include the following:

ARA Consulting Group Limited
ASA Consulting Limited
Bio-Response Systems Limited
Land and Sea Environmental Consultants Limited

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